the Transactions of the Vienna Academy of Science an essay on the polymorphism of an Aphis (*Chætophorus populi*).——A new cave-spider, says *Science-Gossip* for December, has been found in a cave in Tasmania, the female of which measures six and a half inches from tip to tip of the fore and hind legs.——Sharp has detected on the prothoracic stigma of the beetle (Chalcolepidius) trap-door-like lobes closing them so as to prevent the entrance of small mites (Proc. Ent. Soc. London, p. iii).

ZOÖLOGY.

THE DEEP-SEA EXPLORATIONS OF THE "TALISMAN" (*continued*). —The Sargasso sea was then visited, and deep-sea soundings made to ascertain the nature of the bed of that part of the ocean. From Cape Verde, the ocean gradually deepens toward the 25th parallel, when it attains a depth of 6267 meters; but it gradually rises toward the Azores, and, under the 35th parallel, it is not over 3175 meters deep. These results are far from being in accord with the indications on the charts of the Atlantic ocean recently published, where the curves of depth give very considerable inequalities.

Whenever soundings were made, specimens of a very fine ooze, formed of fine particles of pumice, mixed with globigerina, were brought up. This ooze, at first reddish near the Cape Verde islands, afterward became of an almost pure white. Each time the dredge furrowed the face of the sea bottom, it was more or less filled with fragments of pumice stonea nd of volcanic rocks. It would seem as if there were, more than a league under the sea, a great chain of volcanoes parallel to the African coast, and of which the Cape Verde islands, the Madeiras, the Canaries and the Azores were the only points of emergence.

The submarine fauna there is scanty. To the stones were attached brachiopods (*Discina atlantica*). A blind Fusus (*Fusus abyssorum*), and a new genus of Lamellibranchs (*Pygotheca fragilis*), as well as several Pleurotoma, occurred. Some Crustacea, such as hermit crabs (*Pagurus pilimanus*), which lodge in colonies of Epizoanthus, and which have already been dredged on the African coast, some amphipods of the genus Nematocarcinus, Holothurians of the group of Elpidia, of which one species was new, Asterians, Ophiurans, and rare corals, scarcely indemnified the party for the time given to dredging at such great depths.

It was only toward the north limits of the Sargasso sea, near the Azores, where the depths are 3000, 2500 and 1400 meters, that our collections became abundant. The 11th of August, at 2500 to 2900 meters, the *Talisman* party captured the giant of the family of Schizopodes—a Gnathophausia, of a blood-red, measuring almost 0.25 millimeters in length, and meriting well the specific name of Goliath, which has been applied to it. In

the same dredge with this crustacean was found a fish of the group of Stomias, with lateral phosphorescent plates. Further on, at 1500 meters, several mollusks of unknown species (Scaphander, Pleurotoma, and Oocorys), the *Dentalium ergasticum*, a great variety of Crustacea, Holothurians, Asterians, Ophiurans and other Echinoderms, contrasted with the penury of the preceding days.

After visiting Fayal, the *Talisman* explored the uneven volcanic bottoms of the passages between the Azore islands, making several successful hauls at the depth of 1250 meters. Some fishes, large red Aristes, Heterocarpus, Galateas of the genus Diptychus, a squid (Cirrhoteuthis) peculiar to Greenland, Actinias, whose edges close together like a bivalve, many star-fishes, specimens of Lophohelia, with their usual retinue of Mopsea, soft sea-urchins (Calveria), large and beautiful Holtenias, recalling the dredgings some weeks previously off the coast of Morocco.

At a little distance from St. Michel, the declivity of the sea-bottom is very rapid. Some hours after our departure, our sounding apparatus already indicated almost 3000 meters, and some of the species found on the plateau situated west of Cape Ghir were brought up. Among others, some large Holothurians, of an amethystine color. On the following day the depth was 4415 meters, and for four days after it continued to be about the same. 4060 meters the 24th, 4165 the 25th, 4255 the 26th.

The very large fishes of the genus Macrurus, which had been brought up during the expedition, also occurred here. They differed fromt hose of lesser depths. The Scopeli and Melanoceti were here also associated. Some hermit crabs and Galatheas of new form; some Crangons, with red eyes; a gigantic Nymphon of the genus Colossendeis; some Ethusas, different from those already known; some Amphipods and Cirripedes represented the Crustacea.

But this abyssal fauna owed its special physiognomy to the large Holothurians of strange forms which abounded; some whose length reached 0.65 millimeters, and whose violet colors were very intense, belonged to a new species of the genus Psychropotes, so remarkable from the existence of a very much developed appendage, ending behind the body, and resembling a queue; others, of the genus Oneirophanta, were easily recognized by their pure white color and long appendages, which garnished the whole body. Others of a delicate rose, carried on the back an erectile, fan-like membrane; these new Pentagonias were like those found by the *Challenger* at the greatest depths explored. Finally, large Actinians, some of which lived as parasites on the Holothurians, some Hymenasters, Asterians, a Brisinga with few arms, some Ophiurans and a crinoid, were found in the same situations.

Aug. 27th, the sounding apparatus reached a depth of over

5000 meters, and a new species of Neæra, and different Crustacea occurred with others previously dredged. More than fifty rosy Pentagonias were dredged, mixed with a less number of Oneirophanta, Archaster and Ophiomusium, attested the richness of this deep sea fauna.

The bottom of the sea throughout this region is carpeted with a white ooze formed almost entirely of globigerines. Pumice and volcanic stones are mixed with it; but that which surprised us most was to find some pebbles polished and striated with ice at a distance of more than 700 miles from the coast of Europe. The distinctness of the striations could not allow us to admit that these pebbles had been transported by currents, because they would never have rolled, and, besides, they lay at such a great depth, that the tranquillity of the water there should be very great, to judge by the nature of the ooze deposited there. Their presence is probably due to transportation by floating ice, which, during the quaternary epoch, advanced further south than in our day, and which, melting in the part of the Atlantic ocean lying between the Azores and France, let the stones fall on the bottom with the fragments of rocks torn from the bed of the glaciers, and which they had transported there.

Aug. 30th, dredging at the depth of 1480 meters in the Gulf of Gascony, revealed polyps of the genus Lophohelia, with splendid Pentacrini (*P. wyville-thompsoni*), gigantic Mopseas, Gorgonias, and corals, etc.—*A. S. Packard.*

The Nervous System of Antedon.—Various opinions have been held in regard to the nervous system of the crinoids which has been held by some to consist of the bands along the bottom of each ambulacral groove corresponding to the nerve cords of the star-fish, while others have maintained the nervous nature of the axial cord and its connections. Dr. Carpenter first suggested the nervous nature of this cord in 1865, and in 1874 further developed the theory that the axial cords are nerve-trunks, and the five-chambered organ in the centrodorsal basin is their center, and as proof adduced the fact that an eviscerated specimen suddenly and consentaneously closed its ten arms when a needle was thrust into the chambered organ. P. H. Carpenter, in 1876, was the first to maintain the nervous character both of the sub-epithelial bands of the ambulacra and of the axial cord. Recent experiments, carried on by Dr. A. M. Marshall, have established conclusively that the central capsule and axial cords, with their branches, constitute, as maintained by the Carpenters and Perrier, the main nervous system, while the sub-epithelial bands are also probably nervous, but have only a special and subordinate function in connection with the ambulacral tentacles and epithelium. The complex co-ordinated movements of swimming and righting when inverted, are all executed by the axial system, as was

proved by the fact that eviscerated specimens in which the connection of the sub-epithelial bands with each other was destroyed, were capable of executing these movements. The axial cords act both as afferent and efferent nerves. Evisceration causes apparently but little inconvenience to the animal, and the visceral mass is regenerated completely in a few weeks. The apparent morphological difference between the nerve system of the Crinoidea and of other echinoderms disappears upon examination. Taking the Asterids as the lowest term of the series, it will be found that in those creatures, as shown by Hamann, nerve fibrils are found over the entire dorsal surface of the animal. While in Ophiurids, Echinids and Holothurids the ambulacral portion of the continuous nervous sheath of the star-fish has concentrated into a well-defined cord, the remainder being absent; in the crinoids the ant-ambulacral or dorsal part being continuous nerve-sheath of the star-fish has developed into the so-called axial cords, and the ambulacral bands also subsist as a subordinate nerve-system.

HERRICK'S CLADOCERA AND COPEPODA OF MINNESOTA.[1]—In this excellent report we have for the first time a summary of the known genera and species of all our fresh-water, free swimming Entomostraca with the exception of the Ostracodes. It will prove not only useful but stimulating to our inland naturalists. As a pioneer work it is entitled to much credit, since many of our species are identical with those of Europe, and much care is required in the generic and specific descriptions, since the distinctions are based on such slight characters. In the introduction the author shows how important these micro-crustaceans are as scavengers, and in what astonishing numbers they exist, 1442 specimens occurring in a quart of filthy pond water.

The discussion of the affinities and genealogy of the Cladocera is interesting; this is succeeded by an account of the leading works on them. The order, families and genera are characterized with sufficient fullness, and a tabular view of the classification of the Cladocera is given, as well as useful keys to species under each genus. Under the family Daphnidæ a long account of the circulatory system is given from original observations, The Copepoda are treated in the same manner as the other order, and all the species collected by Mr. Herrick or previously known are described, but why no description of *Canthocamptus tenuicaudis*, n. sp., is given, we hardly understand, though it is figured, while *C. cavernarum* Pack., from Mammoth cave, is not mentioned. The number of species of Copepoda seems meager, and

[1] A final report on the Crustacea of Minnesota, included in the orders Cladocera and Copepoda. Together with a synopsis of the described species in North America, and keys to the known species of the more important genera. By C. L. Herrick. From the twelfth annual report of the Geological and Natural History Survey of Minnesota, 1884. 8vo, pp. 191, with 29 plates.

as the author suggests, many new forms remain to be detected. Notes on collecting and preserving these forms, and a few descriptions of marine copepods from the Gulf of Mexico are added. The figures are numerous and fairly well drawn, some being anatomical and embryological in their nature.

The work will do credit to the author and be of service in directing attention to these creatures, and it is to be hoped that the author will be able to add to and extend the work, and in a few years give us an enlarged and improved edition of it, as a hand-book of our fresh-water Entomostraca would be useful.

The plates should have been numbered not lettered; *Limnetis* is spelt *Limnetes*, but the typographical errors are not numerous.

MORPHOLOGY OF THE VERTEBRATE AUDITORY ORGAN.—The chief vertebrate sense organs have certainly had a very different origin. The olfactory organ is probably a modified gill (Marshall). The eye is developmentally and really part of the brain. Such a view was also once held with regard to the olfactory and auditory nerves as well as the eye. But recent researches, especially those of Marshall and Van Wijhe, have proved that the auditory nerve is merely a dorsal sensory branch of the 7th cranial nerve (3d segmental nerve of Van Wijhe).

It has been shown above that the nerves which supply the segmental sense organs are dorsal sensory branches of the segmental nerves, that the segmental sense organs are merely modified portions of the epiblast, that these sense organs primitively, and in some existing form still throughout life, lie free on the surface of the body, but that later in most cases they become shut off from the epidermis in a sac which remains connected with the external world by a small opening. The sensory cells of these organs possess long fine terminal hairs, which are easily affected by wave-motions in the medium in which the animal lives, and which communicate this wave motion to the nerves connecting them with the brain. Do we really meet with this condition of things in the auditory organ? In other words, is the auditory organ merely a specially modified portion of the system of segmental sense organs?

The auditory organ is, like the segmental sense organs, really a modified portion of the epiblast. Very early in development it becomes shut off in a sac from the epidermis, a condition which only arises later in the segmental sense organs.

The semicircular canals, etc., are clearly secondary complications, for in every embryo the auditory organ is at first a simple sac shut off from the epidermis, of which sac a portion of the inner wall consists of two layers of modified epiblastic cells, connected by a dorsal sensory branch of a segmental nerve with the brain.

This double layer of modified epiblastic cells is in every way

comparable to a segmental sense organ. As in the latter the cells on the free surface possess long hairs. These hairs like those of the segmental sense organs are concerned with the perception of wave-motions of the medium in which the animal lives. The hairs on the auditory cells are indeed concerned with the perception of much finer wave-motions—those of sound—than those on the cells of the segmental sense organs, and hence arises the early shutting off of this organ from the skin. The inner layer of cells of the auditory organ is exactly comparable to the inner layer of cells of a segmental sense organ.

In Teleostei, etc., the auditory organ becomes entirely shut off from the skin, but in Elasmobranchii the aperture of invagination persists, and the organ is connected with the surface throughout life, just as the segmental sense organs.

These facts, together with the fact that the auditory nerve is merely a dorsal sensory branch of a segmental nerve, seem to point to the conclusion that the auditory organ of vertebrates is fundamentally a specialized portion of the system of sense organs of the lateral line, specialized above the rest of the system by the acquirement of the more delicate function of the perception of waves of sound.

In accordance with, and as a direct consequence of this function of receiving waves of sound, the auditory organ has been early shut off from the external surface, and has developed accessory structures in the shape of semicircular canals, etc. Thus its primitive simplicity has been lost.

I hope shortly to give elsewhere a more detailed statement of the points touched upon in this paper.—*John Beard in Zoölogischer Anzeiger, 1884.*

Some preliminary notes on the Anatomy of Fishes.—1. *On the cutaneous Sense-organs.*—Since the distinction between *endknospen* on the one hand, and *nervenhügel, nervenleisten, nervenknöpfe* on the other, is generally recognized, it becomes desirable to have English equivalents somewhat less clumsy than the literal translations of these terms. I have found no satisfactory word to replace "endbud," but would suggest for the "nerve-hillocks" and other sense-organs of the same character, whatever their shape, the term *neuromast* with the adjectival form *neuromastic.*

At the meeting of the British Association in Montreal, in September, I pointed out that the catfish possesses neuromasts in sacs, recalling those of the sturgeon. They resemble these, in fact, more closely than do the similar structures of Amia and Lepidosteus, which I have recently studied. The neuromasts belonging to a group are connected by a canal lodged in the corium, which is lined and in places filled by an epithelium, continuous with the epithelium of the neuromasts. Such a canal

has recently been described by Carrière for Cobitis, although he has not recognized its true character. The deep neuromasts found by the same author in Tinca are evidently somewhat similar to those of the catfish, and it is probable that connecting epithelial canals will yet be found. The only explanation of these canals which has so far occurred to me is, that they are the remains of a more complicated system of cutaneous canals similar to those of the Selachii.

In striking contrast to such deep neuromasts are those lodged on the projecting papillæ of the blind fishes. Professor S. A. Forbes has described the distribution of these in his *Chologaster papilliferus*, a specimen of which he has kindly given me for examination. I find that whereas the trunk in this species has only the free neuromasts, the head has neuromastic canals arranged in the ordinary way, and corresponding roughly in their course to the chief tracts of the projecting papillæ. A singular circumstance is, that they have only four openings on each side, one posterior above the gill-aperture and three anterior on the snout, the pores of the mandibular, infraorbital and supraorbital canals respectively.

I take the opportunity of mentioning here that the absence of pigment in the pigmentary epithelium of the retina of this species as very significant.

2. *On the fate of the spiracular cleft in Amia and Lepidosteus.*—It is generally supposed that the spiracles of the sturgeon are unrepresented in Amia and Lepidosteus, but a minute slit may be seen in both genera on either side of the roof of the mouth, immediately in front of the dorsal ends of the first branchial arches, leading into diverticula of the mouth-cavity—the rudimentary spiracles. If a bristle be pushed into one of these slits, it will be found to pass through a canal in the primordial cranium immediately above the anterior end of the hyomandibular articulation, and to be only prevented from emerging on the roof of the skull by the squamosal bone. Sagemehl has seen the canal in Amia without attributing to it any morphological significance. In series of sections through young specimens of both genera, I find a free neuromast projecting from the epithelium of the anterior wall of the distal part of the cleft, supplied by a distinct division of that dorsal branch of the *trigeminus* (the *ramus oticus* of Van Wijhe), which is distributed to the neuromastic canal in the squamosal bone. I conclude that the distal part of the cleft is epiblastic in origin, although Balfour believed (as far as Lepidosteus is concerned) that it never acquires an opening to the exterior. In a recess of the anterior wall of the spiracle in Amia is situated a pseudobranchia. This has recently been styled an "opercular pseudobranchia," in accordance with Gegenbaur's views as to the homology of the pseudobranchia of the Teleosts, but the discovery of its relations to the spiracular cleft demon-

strate its homology with the pseudobranchia of the sturgeon. As there can be no doubt of the homology of the pseudobranchia of Amia with that of the Teleosts, it follows that it is the "opercular" gill and not the spiracular gill which disappears in the Teleosts. Dohrn has recently defended this from another standpoint. Johannes Mueller's view is in opposition to that of Gegenbaur.

The pseudobranchia appears to be represented in Lepidosteus by a mere anastomosis. That genus, has, however, an "opercular" gill (absent in Amia), the two parts of which, although differing in their vascular supply, correspond to the complete opercular gill of the sturgeon. Balfour was unable to find this gill in young specimens of an inch in length. I have arrived at the above result from the study of specimens of two inches.

3. *On the auditory organ of Hypophthalmus.*—In a recent paper I described the connection between the air-bladder and auditory organ in the catfish (Amiurus), paying special attention to the morphology of the modified anterior vertebræ which establish this connection.

Reissner had previously pointed out that in many tropical Siluroids this "Weberian apparatus" is much reduced, but his identification of the altered vertebræ is so out of harmony with my results that I was glad to be able to re-investigate the matter through the liberality of Professor B. G. Wilder, who put at my disposal last spring a number of the forms in question as well as others. As was to be expected, the four anterior vertebræ are always modified in a similar manner throughout the group.

The genus Hypophthalmus, according to Günther, presents an exception to the other Siluroids, in that the anterior vertebræ are not united, but as a fact this genus exhibits an extreme type of reduction of the Weberian apparatus. The four anterior vertebræ are not only united, but the first three of them are telescoped, as it were, into the occipital region of the skull, so that a frontal section through the plane of emergence of the third pair of nerves, falls also through the *sacculi* of the auditory labyrinth. The air-bladder is represented by two entirely separate bladders, about 2^{mm} in length by 3^{mm} in width, almost entirely enclosed in osseous capsules, situated on either side of the fourth vertebra, and coalesced with it. These osseous capsules represent the crescentic ossifications in the external tunic of the air-bladder of the catfish which are attached to the posterior ends of the "*mallei*." All the Weberian ossicles are represented, but the whole apparatus is so reduced as to be obviously quite functionless. In conformity with this the *lagenar* parts of the auditory labyrinths are much smaller than in the catfish, while the *sacculi* of opposite sides still communicate by a transverse duct.

In compensation, as I think, for the reduction of the Weberian apparatus, the neuromastic canals of the head and trunk are

enormously developed, and the dorsal branches of the various cranial nerves which supply these, and which center in the *tuberculum acusticum* of the brain, are correspondingly large. This appears to me an additional confirmation of the theory advanced by Schultze and Mayser, that the cutaneous sense-organs of this class constitute a form of auditory organ.—*R. Ramsay Wright, University College, Toronto, Dec. 18, 1884.*

P. S.—After writing the above, I learn from Professor Wilder that he indicated the existence of rudimentary spiracles in Amia and Lepidosteus at the A. A. A. S. in 1878. His MS., which remains unpublished, discusses the nature of the spiracles and their persistence in a more or less complete form in Selachians, Ganoids and the Teleost Megalops, describes the form and relations of the spircular clefts in the adult Amia, and concludes that these are open in the young.

The relation of the pseudobranchia referred to above is not indicated.—*R. R. W.*

THE LARVA OF ESTHERIA MEXICANA.—(The following descriptions and figures were received from the late Mr. V. T. Chambers in 1873, and overlooked in the preparation of my monograph of North American Phyllopoda. As we know nothing of the development of American Estheriæ except what is given by Dr. Gissler in my monograph, it may be well to publish the drawings and description of Mr. Chambers. I have identified the species from specimens of the shell sent by the author.—*A. S. Packard.*)

I send by this mail the fragments of the shell of the Estheria and two camera drawings of the nauplius in different stages, and a drawing of a section of the shell showing the markings. I do not know whether the nauplius has been previously figured or not, as my knowledge of the genus is confined mainly to Baird's monograph in *Ann. and Mag. Nat. Hist.*, Ser. 2, Vol. VI, p. 53; T. R. Jones in *Quar. Micro. Journal*, and a few references in the *Zoölogical Record.*

Most probably this is your described Kentucky species.[1] Out of the hundreds of eggs only four produced Nauplii, and unfortunately I was only able to observe these in the stages figured. The first form (Fig. 1) was evidently just from the egg, and was observed at 3 o'clock P.M., Sept. 15; the second was observed next day at 8 A.M. I have a preserved specimen of each form: Fig. 2*a* is the shield, which seems to be attached only to the anterior portion of the under side of the thorax; Fig. 2*b* is a side view of the head at this stage, except that the abdomen is too short. Fig. 1 bears a good general resemblance to Baird's figure of *Artemia iun.* It seems to me, however, to approach more

[1] *E. clarkii*, now regarded as a synonym of Claus' *E. mexicana.*

nearly the young of Chirocephalus, especially in Fig. 2.—*V. T. Chambers.*

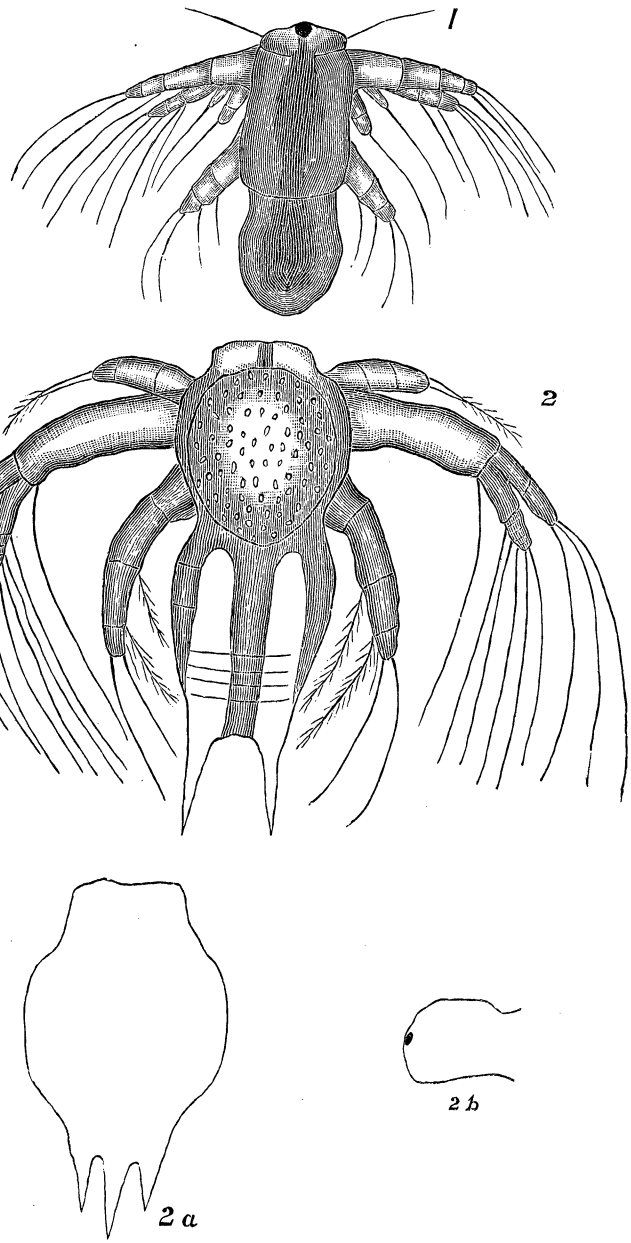

FIG. 1.—*Estheria mexicana*, nauplius just from the egg. FIG. 2.—After the first molt. All highly magnified.

ABERRATION IN THE PERCH.—I wish to note a peculiar anatomical aberration in a common perch (*Perca americana*) which has just come under my observation. In examining some of these fishes from Lake Michigan, an assistant noticed that one of them had no pyloric cœca. The viscera were placed in alcohol with others, and on opening the alimentary canal for the purpose of removing its contents, I noticed a fleshy mass apparently nearly occluding the pyloric opening, the pyloric portion of the stomach being stretched somewhat tightly over it. Finding that this was not detachable I took it for a tumor, but a closer examination showed that it was divided into three finger-like lobes, of the shape and size of pyloric tubes, and that each of these lobes was hollow, opening upon the outer surface of the intestine by an orifice large enough to admit a knitting-needle. Evidently these were the missing pyloric cœca, which had *grown wrong side out;* for I cannot conceive of any accident which should turn these structures within the body of the fish.

The exposed surface is a mucous surface, and that within the cavity of the pyloric tube is a serous surface, like that of the outside of the intestine.—*S. A. Forbes.*

A LIZARD RUNNING WITH ITS FORE FEET OFF THE GROUND.—In the proceedings of the Linnean Society of New South Wales, 1884, it is stated that Mr. Macleay exhibited a lizard which was observed to run for six yards in an erect posture with the fore legs quite off the ground. The lizard was of the genus Grammatophorus, of which there are several species in the country, all of them much given to playing and gambolling on sunny days.

FEATHERS OF THE DODO.—The feathers of the dodo have been studied by Professor Moseley, who read a paper on the subject at the Montreal meeting of the British Association. He showed that the arrangement of the feathers in groups of three each in the dodo had a close connection with the *filoplumæ*, or thread-feathers, one of which is found at each side of the feathers of birds of the dove family, near which the dodo is placed. Earlier in the development of the dove's feathers the *filoplumæ* are larger, relative to the size of the other feathers; and this condition resembles still more the structure found in the dodo.

THE ARMADILLO IN TEXAS.—G. H. Ragsdale, of Gainesville, Texas, informs me that an armadillo was recently killed in northern Denton county, Texas, which is the only animal of the kind ever taken in that part of the country. The armadillo is said to have been common on the Rio Grande river twenty years ago, and is still common in the south-western counties of Texas.—*A. Hall (E. Rockfort, Ohio), in Forest and Stream.*

ANOTHER SWIMMING WOODCHUCK—On page 249 of Dr. C. Hart Merriam's interesting work on the Mammals of the Adirondacks (New York, 1884), the author states that with the ex-

ception of a single case which came under his personal observation, and which he relates in full, he has searched in vain for the record of an instance where a woodchuck (*Arctomys monax*) has been known to swim voluntarily. An instance somewhat similar to the one mentioned came under my own notice in the early part of July, 1877, whilst camping within a few miles of the village of Kempville, some thirty-two miles south of Ottawa. In company with Mr. P. B. Taylor, of the post-office department, I was rowing up "the Branch," a small tributary of the Rideau, when we noticed a large woodchuck come down the bank and take boldly to the water, with the evident intention of crossing to the other side. The stream was at this point about 30 or 40 yards wide, and we pulled hard in order to come up with the animal before he could reach the opposite shore. As soon, however, as the woodchuck saw us he appeared to take in the situation, and made vigorous efforts to escape; and as he could change his direction much more quickly than we could, he succeeded for some time in eluding us. But we finally managed to get within reach of him and I lifted him into the boat by the back of the neck. He shivered a good deal and looked intensely uncomfortable; but his long swim did not appear to have tired him much, for he struggled violently to free himself, and when subsequently released he leaped over the side of the boat and swam back to the shore from which he had come. He swam low in the water, progressing but slowly and with evident exertion.—*W. L. Scott, Ottawa, Canada.*

NEST OF NEOTOMA FLORIDANA (identified by Dr. Coues, with question).—While hunting, the other day, my attention was called to a singular nest of some animal, made on the ground, just in the edge of a clump of mesquite brush. It was in the form of a pyramid or rather oval, about two feet and a half high, and four feet in diameter at the base, constructed of cow chips, stones, sticks, lumps of dirt, and every imaginable light substance that could be collected in the vicinity. There were two holes for entrance in the nest, on opposite sides, about the size of one's coat sleeve. A large thick cactus leaf near one of the orifices had been partly eaten recently. As far as we could ascertain, without destroying the nest, it was unoccupied at the time of our visit. My companion, the signal observer here, is very familiar about here, but this is the only nest of the kind he has seen. A gentleman, who has lived on the Rio Grande, says he has seen them. Can any one tell us what animal lives in this curious nest?—*John D. Parker, Fort McKavett, Texas.*

HAACKE'S DISCOVERY OF THE EGGS OF THE AUSTRALIAN ECHIDNA.—It appears that on Aug. 25, a few days before the announcement (Aug. 29) by telegraph from Australia, of Caldwell's discovery that a monotreme laid eggs, the telegram not

stating whether it was the Ornithorhynchus or Echidna, Dr. J. W. Haacke discovered that Echidna laid eggs. His discovery was reported in the same number of the *South Australian Register* as contained Caldwell's dispatch to the British Association at Montreal. On Sept. 2d, at a meeting of the Royal Society of South Australia, the *Register* reports: "Dr. Haacke laid a number of specimens on the table, including an egg found in the pouch of a female Echidna, in support of the theory that the Echidna, although a milk-giving animal, lays eggs which are hatched in the pouch." Dr. Haacke, in a communication to the *Zoologischer Anzeiger* of Dec. 1, adds: "I found the egg on the 25th of August last in the mammary pouch (not the uterus) of a living *Echidna hystrix*, received about the 3d of the same month from Kangaroo island. The egg was unfortunately decomposed inside, but the circumstance of the mother having been worried by being captured and kept in captivity easily accounts for this." He also says that in dissecting the Echidna he felt a small object in the pouch; in hopes of finding a young Echidna he brought it to the light, and was astonished to behold a veritable egg between his fingers! It was from one and a-half to two centimeters in diameter, and possessed, as many reptilian eggs, a pergamentaceous shell which, under the pressure of his fingers, burst, letting out thick fluid contents. The scientific public will now look with interest to Mr. Caldwell's account of his discovery.

DISTRIBUTION OF MAMMALS.—At the Montreal meeting of the British Association Dr. G. Dobson read a paper on the distribution of mammals, in which he pointed out the remarkable resemblance between certain bats of the Australian and Ethiopian regions. From this it was apparent that some communication once existed between those continents. There probably had been a chain of islands between Australasia and Africa, which had existed for a short period, by which route the bat had passed from one place to another. Bats were widely spread in Madagascar, Mauritius, and Australia, but there is only one species in India which shows a strong resemblance to the Madagascar bats. So it is evident that at no distant day they had common ancestors. It was, therefore, deduced that there must have been a chain of islands from Australia to Madagascar, and at a later period from Madagascar to India. On close examination he felt convinced that the Indian ocean contained many submerged banks between Australia, Madagascar, and India. Professor Moseley said that the Indian ocean had never been examined as to depth, the *Challenger* expedition not touching it. Dr. John Ball urged that the existence of islands and continents was often too dogmatically laid down; he believed that currents could carry trees which might bear animals and plants with them.

ON THE CENTRALE CARPI OF THE MAMMALS.—Professor H. Leboucq, in his "Recherches sur la morphologie du carpe chez les mammifères," Arch. de Biol. Tom. v, 1884, pp. 35–102, pl. III–VI, has made extended communications on this subject. I will add some observations, which will complete Leboucq's results. In this present communication I will speak of the centrale only, and will defer other points discussed by Leboucq to a future extended paper on the morphogeny of the carpus and tarsus of the vertebrates. I have found, like Leboucq and others, a distinct central bone in man, dog and cat. I regret not having been able to examine embryos of bats and marsupials. I can distinguish a centrale in two other specimens of Carnivores, in an embryo of Lutra of $50^{mm.}$ and in an embryo of *Mustela vulgaris* of about $25^{mm.}$ In Lutra the central bone was quite free and very fully developed, the radiale and intermedium were coalesced. In the embryo of Mustela, very much smaller and younger, the centrale was beginning to coalesce with the radiale and intermedium, at that part contiguous to the radiale. In Lutra the radiale and intermedium were entirely coalesced, in Mustela I found traces of a former separation.

In an embryo of *Erinaceus europæus* of $65^{mm.}$ I found no sign of a free centrale and no indication of a confluence of the bone with the radiale. The first tarsal row consisted of two pieces of cartilage, a radiale and intermedium, and an ulnare. In an adult *Erinaceus collaris* I observed the same condition as in the embryo. As in the different families of Insectivores, even in the adult state, a free centrale may be found or not, I do not hesitate to believe, that in all Insectivores in which a centrale has not yet been seen, such a bone will be discovered in embryos at some early stage of their development.

In regard to the Marsupials I have had no opportunity to examine the embryo.[1] In the manus of the following adult Marsupials I can distinguish an os centrale coalesced with the radiale, as Leboucq has stated, viz: *Didelphys azaræ*, *Perameles lagotis* and *Dasypus maculatus*. Further I can state the same for Ornithorhynchus and *Myrmecophaga tetradactyla*.

A centrale carpi is therefore now shown to occur in all orders of mammals except the Ungulata and the Cetacea.

Hyrax capensis possesses, as is well known, a free central bone. Professor Cope places the Hyracoidea together with the Condylarthra in the order Taxeopoda, and considers these the oldest ungulates. If there is a free centrale in one of the oldest ungulates, *Hyrax capensis*, such a bone should exist in the allied forms of this and in the descendants of the Taxeopoda, and I have no hesi-

[1] Since writing the above, I have distinguished in an embryo of Didelphys, 9.5^{mm} long, a partially free central bone. My thanks are due Professor H. Osborn for the opportunity of making the examination.

tation in believing that such a bone will be found in the Amblypoda[1] and in embryos of Elephas, Tapir, Rhinoceros and Hippopotamus. Whether it is coalesced with the radiale or with the trapezoid (tars.^{II}) or whether it has become wholly atrophied, I am not able to decide. (According to Flower: Osteol. of Mamm., II edit., p. 265, in *Hyrax dorsalis* the central bone is coalesced with the trapezoid.) It would be interesting to know whether in the Periptychidæ, the Phenacodontidæ and the Meniscotheridæ, the three families of Cope's Condylarthra, indications of a central bone can be found. It seems improbable that such indications must exist. Furthermore in regard to the Cetacea. If Leboucq's hypothesis, that we might consider in these animals certain "metacarpiens" as "carpo-metacarpiens" should be shown to be correct, then this last point would be elucidated.

Further morphogenetic researches on the limb-skeleton of the vertebrates will remove many present uncertainties and errors. I would hence be glad to receive, from those interested in the subject, any embryological material that will enable me to make further investigations upon these points. The most important stages are, when cartilage begins to appear, or is already developed. In future studies I hope, so far as possible, to elucidate the morphology of the limb-skeleton of vertebrates and to bring to light new points on the phylogenetic relations of the different groups of vertebrates.—*Dr. G. Baur, Yale College Museum, New Haven, Conn., Oct. 1884.*

THE TRAPEZIUM OF THE CAMELIDÆ.—Professor Cope[2] says in regard to the carpus of Poëbrotherium, one of the ancestors of the Camelidæ: "The carpus consists of eight bones, the entire mammalian number, all entirely distinct. The second series presents the most important peculiarities. The trapezium is small and posterior; the trapezoides has an almost entirely lateral presentation, and is also small, and fits an angle of the magnum. There are two principal and two rudimental metacarpals. The second and fifth are very short and wedge-shaped, and closely adherent in shallow fossæ of the third and fifth, respectively."

It is generally considered that the living Camelidæ have no trapezium. I cannot, however, agree with this assumption. At the posterior part of the trapezoid of an adult *Camelus bactrianus* L., I find a well developed articular surface; it is the same face that is seen in different Cervidæ,[3] and can only be for the trapezium.

[1] Professor Cope believes that there is an os centrale ("intermedium") in Coryphodon.

[2] Annual Report of the U. S. Geol. and Geog. Survey for 1873. Washington, 1874, p. 499.

[3] Baur, G. Der Carpus der Paarhufer. Eine morphogenetische Studie (Vorläufige Mittheilung). Morphol. Jahrb. 9, 1884, pp. 600.

Between Poëbrotherium and the living camels stands, according to Professor Cope,[1] the genus Procamelus. In regard to this latter, Cope says, p. 262: "Thus the lateral rudimental metacarpals of Poëbrotherium have disappeared, and with them the trapezoides of the carpus." (This is evidently a typographical error; instead of trapezoides it should read trapezium.)

Now if there is a trapezium in one of the living Camelidæ, as I have found, there ought to be one in the older form—Procamelus. That this is in fact so, seems apparent from the figure given by Cope[2] of *Procamelus occidentalis* (Pl. LXXIX, fig. 3*a*). There appears to be an articular surface, at the back part of the trapezoid and it would be interesting to prove it definitively.

The presence of a trapezium in the Camelidæ shows that they, like the Cervidæ, are ancestral forms of the ruminants. I will discuss this in another place.

I do not doubt that we will find in the carpus of camel embryos the same condition as in Poëbrotherium. It would be interesting to examine embryos with this view.—*Dr. G. Baur, Yale College Museum, New Haven, Conn., Nov., 1884.*

LAST APPEARANCE OF THE BISON IN WEST VIRGINIA.—The following letter we owe to the kindness of Professor J. Packard of the Theological Seminary of Virginia. The facts regarding the last date of the appearance of the buffalo in West Virginia will be interesting in connection with the statements in J. A. Allen's work on the American bison, living and extinct.

PRINCETON, MERCER COUNTY, W. VA., April 26, 1877.

Your letter was received several days ago, and would have been answered before this, but was delayed by me with the hope of arriving at such information as some of the oldest of our citizens might be in possession of, which I expected to obtain at our last week's court. I have failed to get but little beyond the slight traditions I had before; to sum it all up, I think the last buffalo killed on Guyan river was killed by a man named Morgan, on a creek and at a lick called Buffalo, about four miles from its mouth that empties into said Guyan, and about fourteen miles from Logan C. H., and in the County of Logan, in the year 1804. Another one was killed, and perhaps the last one heard of, by Joseph Workman on the Deer Skin fork of Coal river, about the year 1810. This information I got from old Stephen Blankenship, who is now in his eighty-sixth year. I learn that old Mr. Workman is still living, and is ninety-five years old; the buffalo was killed in the present County of Boon, where he now lives. My impression was, before the receipt of your letter, that the last one

[1] Cope, E. D. The Phylogeny of the Camelidæ, Proc. Ac. Nat. Sci. Phil., 1875, p. 262.

[2] Report Expl. Surv. W. of 100th Mer. U. S. G. M. Wheeler in charge, IV, pt. 2, 1877.

was killed on Coal river, but think they did not remain in the State later than about 1805. A few elks lingered longer, perhaps as late as 1820. I think you might obtain, perhaps, the most accurate information in reach from Col. Benj. H. Smith (P. O. Charleston, Kanawha county, W. Va.), who is an intelligent old gentleman, and has practiced law in all the counties where the buffalo was seen last, he, I think, would likely remember the hunters' account of his departure from the State.

N. B. FRENCH.

ZOOLOGICAL NOTES.—*Worms.*—The despised earthworm appears, from a letter of Mr. F. E. Beddard to *Nature*, to be capable of attaining considerable dimensions. *Megascolex cæruleus*, said to be abundant after heavy showers in some parts of Great Britain, is represented in the British Museum by specimens more than two feet long. Two distinct genera of large sized earthworms, *Antæus* and *Titanus* Perrier, inhabit South America. The genus Acanthodrilus, from Western Africa, has two species which attain a length of three feet. An earthworm two to three feet long occurs in the interior of New Zealand, and a similar one in South Australia. But the largest known species is from South Africa. Forty years ago Rapp figured an earthworm six feet two inches long, obtained near Port Elizabeth, and recently Mr. Beddard procured a living example of the same species between four and five feet long and half an inch thick, from the same locality. It expands and contracts within wide limits, and may even be longer when fully expanded. Externally it resembles Lumbricus, in having four series of pairs of bristles on each segment, but its internal structure is quite distinct. This worm seems to be abundant, but is rarely seen, as it is only driven from its underground burrows by heavy and prolonged rains; on such occasions, which only occur a few times a year, the ground is covered by hundreds of these creatures, slowly crawling around until killed by the sun. A curious fact in connection with these worms is that the hard clayey soil in which they reside contains brackish water, thus proving that the presence of salt does not necessarily kill earthworms and their eggs, as has been supposed. The genus Pontodrilus Perrier lives among decaying seaweed cast up by the sea. ——Earthworms would appear to be exceedingly abundant in some parts of New Zealand, if we may judge from Mr. Urquhart's paper, in the transactions of the New Zealand Institute. The writer calculates that there are in one acre of pasture land near Auckland, 348,480 worms, with a weight of 612 pounds 9 oz.

Crustaceans.—In describing the head of *Palinurus lalandii*, Professor T. Jeffrey Parker divides the genus Palinurus into three sub-genera. Species in which the stridulating organ is absent, and the procephalic processes present are named Jasus; those with the stridulating organ and without the procephalic processes, Palin-

urus; while Gray's name, Panulirus, is retained for the longicorn species. All the species of Jasus (omitting *P. longimanus* and *P. frontalis*, of which no definite information could be obtained), are confined to the southern hemisphere, those of Palinurus to the northern, while those of Panulirus occur in both.

Fishes.—Mr. R. M. Johnston, in the Proc. Roy. Soc. of Tasmania, enumerates 188 known species of Tasmanian fishes. Of these about one-third are good edible fish, though only twenty-one are sufficiently abundant to be of importance. *Lates colonorum*, a well-known species in Australia, seems, in Tasmania, to be confined to one small river on the north-east of the island.

Mammals.—Mr. G. E. Dobson states that many of the most characteristic species of Australian Chiroptera have their nearest allies in the Ethiopian region. Thus Chalinolobus and the subgenus Mormopterus are South African and Australian. *Megaderma gigas*, of Queensland, has its nearest ally in *M. cor* from Eastern Africa, and Triænops, a remarkable leaf-nosed bat found in Madagascar, Eastern Africa, and Persia, has its nearest ally in the *Rhinonycteris aurantia* of Australia. Finally, Australia agrees much more closely with Madagascar, and the Mascarenes than with the oriental region, in the species of Pteropus, eighty per cent of which inhabit the Australian region and Madagascar, with its islands.——Mr. G. E. Dobson (Proc. Zöol. Soc., April, 1884) describes the myology and visceral anatomy of *Capromys melanurus*. The specimens on which the description is based were from the mountains of the southern end of Cuba, and appear to be the first of which the complete bodies preserved in spirit have reached Europe. The four known species of Capromys, *pilorides*, *brachyurus*, *prehensilis* and *melanurus* are confined, so far as known, to the islands of Cuba and Jamaica, where they are the only indigenous rodents. *C. brachyurus* is limited to Jamaica, the others to Cuba. The liver of this species differs remarkably from that of *C. pilorides*, in the absence of that sub-division of the hepatic lobes, which has been described in the latter species, and has been thought a generic character.——M. Testut (Bull. de la Soc. Zool. de France, VIII, 1883) has observed in twenty subjects the fusion of the flexor muscle of the thumb with the general flexor of the digits. As the presence of a separate muscle for the flexure of the thumb, causing that digit to be perfectly independent in its movements, is one of the characters made much of by those who wish to find a broad difference between man and the apes, it is significant to find this character so often absent. In three cases the two flexors were completely united into a single muscle. To meet with this character it is necessary to go back to the Cercopitheci, for in the anthropoid apes the muscles have a greater or less tendency to separation. In the gorilla, the flexor muscle divides into two parts, one of which goes to the thumb and first finger, the other to the re-

maining three fingers. This anomaly was found by M. Testut on both arms of one subject. In the orang, not only are the two deep flexors united, but there is no tendon for the thumb, and this abnormality has been observed in man by Gruber, Wagstaffe, Gegenbaur, and Chudzinski. M. Testut believes that he can trace the presternal muscle, which in three or four per cent of the human subjects that have been dissected is present, and is connected above with the sterno-mastoid tendon and below to the great oblique, to the condition of things which obtains in serpents (or rather in vertebrates deprived of a sternum) in which the great oblique is attached to the mastoid apophysis. The sterno-mastoid and great oblique muscles are identical in their position with regard to the tegument, their direction, and their insertion on the haemal axial line, but where a sternum is present, the muscular fibers which descend from the mastoid apophysis find insertions upon it and upon the clavicle, and the part intervening between these insertions and what is now the great oblique becomes atrophied. Muscular anomalies are frequent in man, but M. Testut, in an important work upon this subject, shows that the muscles subject to these anomalies, which disappear entirely in some, while in others they are abnormally developed, are muscles which play an unimportant part in the human economy, and are links which unite man to the lower animals.

EMBRYOLOGY.[1]

THE DEVELOPMENT OF THE RAYS OF OSSEOUS FISHES.[2]—Since the time when Vogt published his work on the development of the salmonoids, in 1842, it has been known that the earliest traces of rays to be noticed in the fin-folds of young fishes were fine, very numerous filaments, lying parallel to each other. Th. Lotz,[3] in 1864, carried Vogt's observations farther, and thought he showed that by the coalescence of these filaments the rudiments of the permanent rays were laid down. Both A. Agassiz and myself have found these filaments in the embryo of numerous widely separated genera of teleosts; the former having also pointed out their existence in Lepidosteus. They also exist permanently in an almost unmodified form in the Dipnoans, as shown by the researches of Günther and others. Balfour and myself have found these filaments in all of the fin-folds of Elasmobranchs, though they seem to be wanting in the more fleshy pectoral of some of the Rays. They are present in the fin-folds of embryo sturgeons, and there probably give rise to the permanent

[1] Edited by JOHN A. RYDER, Smithsonion Institution, Washington, D. C.

[2] Abstract of portion of a paper on the theory of the fins, to be published, with plates, in the Proc. U. S. Nat. Museum.

[3] Ueber die Schwanzwirbelsäule der Salmoniden, etc. Zeitsch. f. wiss. Zool., XIV, 2 Heft.